

the bottom water by conduction and convection, must all be taken into account before a true explanation could be arrived at. It is intended to devote special attention to the effect of radiation on the sand, and of the heated or chilled sand on the tidal water which flows over it, it being probable that it is in this way the key to the curious tidal perturbations of temperature may be found.

THE PHILOSOPHICAL SOCIETY OF GLASGOW

THE *Proceedings* of the eighty-first session have just been published in the form of a volume of 428 pages, and consisting of twenty-four papers, three plates, and a map. The papers are: an address on some of the chemical industries of the country, by Mr. R. R. Tatlock, President of the Chemical Section; on technical education, by Mr. Henry Dyer, C.E.; a discussion of Mr. Dyer's paper, by Mr. E. M. Dixon, B.Sc.; an introductory address on the definition and scope of geography and ethnology, by Dr. W. G. Blackie, President of the Geographical and Ethnological Section; on the use of litmus, rosolic acid, methyl-orange, phenacetolene, and phenolphthalein as indicators, parts ii. and iii., by Mr. Robert T. Thomson; on an easy way of determining specific gravity of solids, by Dr. Dobbie and Mr. John B. Hutcheson; note on Mr. Joseph Whitley's centrifugal mode of casting steel plates for shipbuilding, &c., by Dr. Henry Muirhead, President; notes on Cleopatra's Needle, by the President, on the occasion of presenting a large bronze model of the Needle to the Society; on a new method of measuring the heat-conducting power of various materials, such as cotton, wool, hair, &c., by Mr. J. J. Coleman; on a new thermometer or thermoscope, by Mr. Coleman; on the measurement of electric currents and potentials, by Sir William Thomson; a sketch of the life and work of Dr. Allen Thomson, by Dr. McKendrick; note on modern forms of the microscope, by Dr. W. Limont; on the chief features of the physical geography of China, by Rev. A. Williamson, B.A., LL.D., Missionary in China; on the recent progress of chemistry at home and abroad, by Prof. J. J. Dobbie; on the analysis of commercial carbonate of potash, by Robert Thomson; on a new process for the separation of nickel and cobalt, by Dr. John Clark; on an endless solenoid galvanometer and voltmeter, by Prof. James Blyth; on the chemical composition of the methyl and ethyl alcohols, by Dr. Otto Richter; on the Island of New Guinea, by Dr. W. G. Blackie, illustrated by a map published by permission of the Royal Geographical Society; on the consumption of smoke, especially in great cities, by Mr. A. Pinkerton; on rickets in Glasgow and neighbourhood, and the relation of the disease to food and water used by the inhabitants, by Mr. James Thomson, F.G.S.; and the Graham Lecture by the late Dr. R. Angus Smith, prepared for publication by Mr. J. J. Coleman.

The last paper is probably the most interesting and important of all, inasmuch as it contains many unpublished letters of Thomas Graham, so full of information as to his work and the circumstances in which his work was done that it cannot fail to attract the notice of all engaged in physico-chemical research. The paper has a mournful interest also as being the last from the late Dr. R. Angus Smith. It will be published separately, in a small volume, for the use of those who desire to have a memorial of Thomas Graham.

The Society has a membership of 690. Its work is carried on not only by the parent Society, but by five sections—Chemistry, Biology, Architecture, Sanitary Science and Social Economy, and Geography and Ethnology.

SCIENCE IN RUSSIA

THE Kazan Society of Naturalists continues its useful work of exploration. The last volume of its *Memoirs* (*Trudy Obshchestva Estestvoispytateley pri Kazanskoy Universite, vol. xii.*) contains two papers by the late M. Shell, on the botanical geography of the provinces of Ufa and Orenburg, being a list of 1054 Spermatophores already known from these two regions which have an intermediate flora between that of South-Eastern Russia and that of the Caspian Steppes. A most useful addition to the knowledge of the flora of these provinces is contained in the second paper by the same author, which gives a list of no less than 511 species of Sporophores (28 Vascular plants, 49 Mosses, 2 Charæ, 181 Algæ, 94 Lichens, and 157 Fungi). The importance of this addition may be seen from the fact that, before

M. Shell's work, only 39 species of Sporophores were known from these two provinces. It is worthy of notice that M. Shell has found among the Algæ the *Asterionella formosa*, Hassel, which has been discovered in England and was found on the Continent only by Brébisson in France, and by Heiberg in Denmark. The death of M. Shell in 1881 at Vilno was a great loss to Russian science. In the same volume M. Bekarevitch publishes his "Materials for the Flora of Kostroma," being a list of 514 species of Phanerogams and 18 Cryptogams. M. Flavitzky publishes his researches into the pitchers of different Conifers. The author has studied the deviations of their planes of polarisation, and has found that the value of the angle of deviation is quite characteristic for different pitchers; it varies from $-42^{\circ}2$ (*Pinus abies*) to $-13^{\circ}1$, $-10^{\circ}9$, and $-9^{\circ}6$ for the *Pinus sylvestris*, *P. cembra*, and *Abies sibirica*, and from $+9^{\circ}1$ to $+27^{\circ}2$ for the *Abies balsamea* and *Larix europæa*. We must notice also the elaborate researches, by A. Dogel, into the structure of the retina of the Ganoid fishes. These researches fill a gap which was pointed out many times; they are accompanied by excellent plates engraved at Leipzig.

The minutes of proceedings (*Protokoly*) of the same Society are especially interesting for mathematicians, as they contain a number of notes by MM. Maximowitch, Klark, and others. They are followed by papers on the motion of liquids in elastic tubes, by Prof. Gromeka; on the ichthyology of Kazan, by N. Vapakhovsky; and on the dangerous insects of Samara, by E. Peltzam.

The new volume of the *Memoirs* of the Kharkoff Society of Naturalists (*Trudy Obshchestva Ispytateley Prirody pri Kharkovskom Universite, vol. xvii.*) contains a paper by N. Koulchitzky, on the structure of the "Grandry corpuscles," being a description of that special form of corpuscle by which the nerve is terminated in the tongue of the duck, which M. Grandry distinguished in 1869 from the corpuscles of Herbst (or Pacini's with other animals). The paper is accompanied by three lithographed plates. M. Byeletzky's posthumous paper, on the physiology of the aerial or natatory bladder of fishes is a very elaborate memoir on this subject. The author, who has taken notice of nearly all the researches made in the same direction during more than a century, gives a detailed anatomical sketch of the bladder, and a summary of all known as to its contents. His own researches have been made on fifty-four individuals belonging to the following six species:—*Cyprinus carpio*, *Carassius vulgaris*, *Tinca vulgaris*, *Abramis brama*, *Idus melanotus*, and *Perca fluviatilis*. The gases contained in the bladder are: nitrogen, from 81 to 96 per cent. of the whole (sometimes even 98); oxygen, mostly less than 10 per cent., and very seldom from 15 to 20 per cent.; and carbonic acid from 2 to 5 per cent., falling to 0.6, and very seldom reaching more than 7 per cent. The contents of carbonic acid depends very much upon the conditions which the fish has been kept in before the experiments; but it stands in no correlation at all with the contents of oxygen. The amount of both may be simultaneously small, or greatly above the average. As to the origin of the gases in the bladder, the author indorses the views of Configliachi (Schweigger's *Journal für Chemie und Physik*, Band i. 1811), and concludes that they are not indebted for their origin either to digestion or to the supposed "swallowing" of air on the surface of the water; individuals kept for months under water, without having the possibility of reaching its surface, having been found to have the same composition of gases in the bladder as free individuals. It would rather seem that, with the raising of the fish on the surface, which is accompanied by a diminution of atmospheric pressure, a part of the gas is expelled from the bladder. The most probable origin of the gases in the bladder seems to be—Configliachi said—that the air contained in the water and entering into the mouth of the fish is in some way (perhaps in that pointed out by Erman) eliminated from it; it is dissolved in the blood of the gills, and the oxygen is slowly assimilated by the blood; while the remainder, that is, nitrogen and some oxygen which has remained dissolved, are secreted from the blood into the bladder. This is also the opinion of M. Byeletzky, who considers that blood, as also the lymph, is the source whence the gases of the bladder originate. Contrary to Configliachi's opinion, they are not secreted, however, by the "red corpuscles," but rather by the capillary vessels of the mucous membrane of the bladder; such was also the opinion of Rathke and Johann Müller; however, the argument by which they tried to establish this view cannot be longer held. In

a paper on the microscopic structure of the coal of the Doltz basin, M. Jenjourist shows that the coal contains remains of Sigillariæ and Lepidopendrons, while several Russian geologists are inclined to consider it as having originated only from marine Algae. M. Dybovsky contributes to this volume a description of a new species of fresh-water sponge from Southern Russia, which is closely allied to the *Dosilia baileyi* of Mr. Carter, and to which he gives the name of *Dosilia stepanowii*; it is figured in a plate. Finally, M. Shevyreff gives a list of *Hymenoptera terebrantia* of the Governments of Kharkoff and Poltava; and M. Yaroshevsky publishes his fifth supplement to the list of Diptera of Kharkoff.

The last two volumes of the *Memoirs of the St. Petersburg Society of Naturalists (Trudy Sanktpeterburgskago Obschestva Estestvoispytateley*, vol. xiii. fasc. 2, and vol. xiv. fasc. 1) contain, besides the minutes of proceedings (which unhappily do not go further than March 1883), several valuable papers. Geology is the most favoured branch. Thus we find in vol. xiii. an interesting paper on the waterfalls of Northern Esthonia, by P. N. Vemikoff. The orography of the country whose Silurian deposits are cut towards the north by the abrupt terrace of the Glint, the lower parts of which contain looser strata easily destroyed by the water (as in the Niagara), favour the development of waterfalls, the chief of which are described by the author. In the same volume MM. Koudryavtseff and Sokoloff publish a geological description (with a geological map) of the district of Kromy in Orel. The Quaternary formations are represented by the "black earth," loess, and mighty sheets of boulder-clay which cover the chalk, the Jurassic clays, containing spherosiderite, and the Devonian limestones, marls, and dolomites, appearing in the north. The paper is accompanied with a map on a large scale. In vol. xiv. we find a very interesting orographical sketch of the Kola peninsula, by N. Koudryavtseff. The author has devoted much attention to the leading features of this tableland, and the modifications its surface has undergone under the action of the ice-sheet of the Glacial period. The structure of the mountains; the parallelism of the valleys; the glacial erosion, which has covered the whole of the country with numberless depressions running in the direction of the glacial striation, and producing what might be called "telescopic striation"; the finer glacial striæ, which run north and south, or north-north-west to south-south-east; the "glacial landscape" of the country; and finally its upheaval, are dealt with by the author. Several indications led the author to admit that the peninsula is rapidly rising up, the surest of them being the find of colonies of *Balanides* at a height of 8 metres above the sea, and the discovery of the *Buccinum undatum* (which still inhabits the White Sea), together with broken shells of Brachiopoda and Lamellibranchiata, about 280 feet above the present sea-level, at Kandalaksha. N. A. Sokoloff contributes to the same volume a note (with a plate) on the find of teeth of *Mastodon arvernensis* in the Crimea, at Zamruk, which would imply a wider extension of Pliocene in the yet unexplored steppes of the peninsula; and on the find, also in the Crimea, of teeth of *Hipparion gracile*, which was so widely spread during the Tertiary period from the prairies of the Missouri to the Himalayas. We notice also a note by P. P. Kudryavtseff, on prehistoric man on the Oka; and another note by M. Polyakoff on the bottom-moraine at Wiborg, in Finland.

In other branches of science we have to mention a sketch of the Phanerogam flora of the Government of Minsk, by W. Paszkewicz (vol. xiii.). It contains 958 species, the whole number reaching probably about 1000; 40 of them are new for this region. In vol. xiv. we find a note by M. Szihowsky on the chemical constitution of different parts of the *Zea Mays*, and two preliminary reports, botanical by A. Krasnoff, and zoological by A. Nikolsky, about explorations in the Altai Mountains. The collections of 720 Phanerogams and 100 Cryptogams, which have been brought in by M. Krasnoff, will surely yield interesting data. As to M. Nikolsky, he gives a lively sketch of the fauna of the Altai, followed by a list of observed species: 50 mammals, one of which, *Talpa altaica*, is new; 169 birds, a few reptiles and amphibia, and 16 fishes. A plate gives the comparison of the *T. altaica* with the *T. europea*.

RECENT MORPHOLOGICAL SPECULATIONS¹

III.—Non-segmented Animals

THERE are certain groups of animals about whose systematic position naturalists never seem able to remain long agreed. These groups are changed from place to place in our schemes

¹ Continued from p. 227.

of classification; and often each new discovery seems to confute a current theory only to confirm that which preceded it. More than any other groups, the Polyzoa, Brachiopods, and Mollusks have been shifted from point to point, and it seems almost too much to expect that they have even now found a permanent resting-place.

The Polyzoa were brought into connection with "Mollusks" more than fifty years ago, when Milne-Edwards exhibited their supposed affinities with Ascidiæ, and their Molluscan affinities were more fully admitted when Von Siebold compared the Polyzoan lophophore and tentacles with the arms of a Brachiopod. Milne-Edwards, in combining Polyzoa and Tunicates in his new group Molluscoidea, argued the identity of the type in every detail of structure, and Huxley ("English Cyclopædia," 1855), laying more weight than previous writers had done on the affinities of Polyzoa with Brachiopods (as Mr. Albany Hancock was perhaps the first to suggest) definitely included this last class also in the group Molluscoidea. The Brachiopods seemed, in the light of that time's knowledge, to take a very natural position among the "neural Mollusks," between the Polyzoa on the one hand and the Lamellibranchs and the Pteropods on the other (*Proc. Roy. Soc.* 1854, p. 117).

But in the course of the next ten years Kowalevsky's discovery of *Loxosoma* seemed to supply a link between the Polyzoa and Worms, and Gegenbaur, and afterwards Haeckel, emphasised this relation, and finally included the Polyzoa in the latter group. The Tunicata had by this time obtained, through Kowalevsky's researches, an established position far removed from their former allies in the "Molluscoidea," and Gegenbaur now analysed more critically the differences between Polyzoa and Brachiopods, and (denying that either had any affinity with Mollusks) maintained the eminently isolated position of Brachiopods, and asserted that their arms could no more be compared with the tentacles and lophophore of Polyzoa than these could with the branchial tufts of the Tubicolæ. The discovery by Kowalevsky (1874) of the apparently segmented larva of *Argiope*, &c., seemed to reveal almost obscured genetic relations with the Chaetopods, and at the same time Morse, working chiefly on *Lingula*, argued elaborately that the Brachiopods are much modified Annelides. Ray Lankester, on the other hand, upheld the Molluscan affinities of both Polyzoa and Brachiopods, and Huxley, in his "Anatomy of Invertebrates," kept the three groups in close juxtaposition. Lankester compared Rhabdopleura minutely with the embryo of *Pisidium* (*Phil. Trans.* 1874), and maintained the common origin from a primitive ciliated girdle of the gill-filaments of Lamellibranchs, the lophophore of Polyzoa, the arms of Brachiopods, the tentacles of Phoronis, the velum of embryo Mollusks and of Rotifers, and the ciliated proboscis of Gephyrea. Huxley ("Invertebrates," p. 674), influenced on the one hand by Lankester, and by Steenstrup and Morse on the other, proposed to combine Polyzoa and Brachiopods under the name *Malacoscilices*, to indicate relationship both with Mollusks and with Worms. Lastly, Caldwell (*P. R. S.* 1882), by his researches on Phoronis, has thrown new light on the structure of both Polyzoa and Brachiopods, and, in Lankester's words ("Encycl. Brit.," Art. "Mollusca," 1884), "has established the conclusion that the agreement of structure supposed to obtain between Polyzoa and true Mollusca is delusive; and accordingly they, together with the Brachiopoda, have to be removed from the Molluscan phylum."

We may examine this last important view more closely, and try afterwards to discuss the probable ancestry of these three much-debated classes.

Actinotrocha, the larva of Phoronis, is, according to Caldwell, a perfect and typical trochosphere. The larvæ of Brachiopods and Polyzoa are trochospheres in which, by a shortening of the "dorsal" surface, mouth and anus have been approximated, and the ventral surface has been enormously distended. The same change takes place, and to an even greater extent, in the "metamorphosis" of Phoronis: the adult animal has both mouth and anus situated at one end of a long body; the line joining them is the contracted dorsal surface; an epistome, said to be the persistent præ-oral lobe of the larva, lies between mouth and anus; a lophophore, whose new tentacles are added on either side of the median dorsal line, surrounds the mouth; within its concavity, on either side of the anus, lie two ciliated pits, whose homologue is found in Rhabdopleura. A single pair of nephridia exist. The body-cavity is traversed by mesenteries, one of which is ventral, and attaches the outside of both descending and ascending limbs of the alimentary canal to the body-wall; two are lateral, and pass from the side of the stomach to the body-wall, dividing the